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AVAILABILITY AND UTILIZATION STATUS OF CLEVER BOARD AND MULTIMEDIA PROJECTORS FOR PHYSICS EDUCATION IN COLLEGES OF EDUCATION IN ENUGU STATE

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Abstract
Students' consistent poor achievements in physics have been attributed to non-availability and non-utilization of ICT resources among others. This study therefore, sought to investigate the Availability and Utilization Status of ICT Resources for Physics Education in Colleges of Education in Enugu State. The area comprised all the 8 accredited public and private Colleges of Education in Enugu State. Census survey research design was adopted for this study. No sampling was involved due to the manageable size of the population (30 physics lecturers: 21 males and 9 females). Six research questions and six null hypotheses guided the study. The instrument for data collection was a structured questionnaire, developed by the researcher, validated by three experts and trial tested on 7 physics education lecturers. The researcher administered the instrument to the physics lecturers in the public and private Colleges of Education in Enugu State. The responses were collected and Kuder-Richardson's formula-20 (K-R-20) (availability status) and Cronbach alpha (utilization status) statistics were employed to compute the internal consistency estimate of the items. The reliability coefficient obtained was 0.96, which shows that it is reliable. Research questions were answered using mean, and standard deviation. The results of the study indicated that ICT resources are available but fairly utilized by the physics lecturers for teaching and learning Physics in Colleges of Education in Enugu State. It was recommended that lecturers in the Colleges of Education in the state should make up their minds to embrace and harness the new learning systems which ICT tools brought by the emerging technologies for improving teaching and learning outcomes in schools and colleges.

Keywords: Physics, Colleges of Education, Multimedia, ICT, Availability and Utilization

Introduction

Science Education is defined as all educational processes aimed at providing unlimited opportunities for learners to understand and utilize the necessary knowledge, skills and attitudes required to operate effectively in a scientific and technological society. Science education is an integral field of study which considers both the subject matter of

science discipline such as Biology, Chemistry, Physics, Agriculture, and so on, as well as the process involved in the teaching and learning of science. Science Education imparts knowledge and skills in a systematic way of processing knowledge about the physical world to the learners. For this reason, science education therefore provides knowledge-required to improve health, nutrition, family planning, environment, agriculture and industry. Science education has two broad purposes. The first purpose is to promote scientific literacy among citizens on matters directly affecting their lives and the society. It is a significant part of human culture and represents one of the pinnacles of human thinking capacity. This is essential for the sustainable development of a modern, technological society. The second purpose is to build up technological capability by equipping the future workforce with essential science-based knowledge and skills and by preparing students for scientific disciplines and science-related careers in higher education (Abubakar, 2014). By acquiring scientific knowledge, students have the opportunity to develop as independent learners utilizing personal learning and thinking skills. They also have opportunities to practice and develop functional skills in literacy, numeracy, information and communications technology (ICT). The provision of quality science education to all learners has far reaching consequences on a country's development and prospects. Practical activities in science education in general and in Physics Education in particular are regarded as one of the necessary elements to promote understanding of scientific principles for national development.

Physics as one of the science subjects deals with the study of matter, energy, and the interactions between them. Physics is the bedrock of science and technology because many of the principles on which the scientific and technological advancement depends, are direct products of Physics and cuts across all other science subjects. Researches in Physics have paved way for many brilliant inventions and discoveries. In the areas of agriculture, electricity, aviation, health, telecommunication among others, physics concepts are applied (Ugwuanyi, 2013). The knowledge of Physics equips the learners with problem-solving and decision-making skills that pave way for critical thinking and inquiry that helps in responding to radical changes in all facets of life (Bello, 2011).

The teaching and learning of Physics in Colleges of Education (COE) is aimed at training qualified and competent Physics teachers who would in turn, contribute towards nation building by teaching physics to students at the secondary school levels and tertiary education levels. Therefore, it is imperative to monitor students' achievement at the Colleges of Education so as to nip in the bud all negative factors that might affect their performances. When such factors are diagnosed and eliminated to ensure the production of the right caliber of Physics lecturers, then the aforementioned national development would be realized (Alachi, Owadara, Nwosu, Njoku & Nwokoma, 2017). For the scientific and technological development of any nation to be attained, Physics knowledge is very much required. It is therefore necessary that physics as a science subject be given the much needed attention it deserves at both secondary school levels where the foundation is laid in preparation for entry into other tertiary institutions and in COE

where the students are trained as future physics teachers among other areas. Tertiary institutions in Nigerian education system include Universities, polytechnics, colleges of education and monotechnics.

Colleges of education (COE) are institutions where teachers are given professional and intensive training and are certified teachers. Colleges of education are managed by a body called National Commission for Colleges of Education (NCCE) who provides and regulates the activities of College of Education. NCCE is responsible for designing and delivering their programs and offer all subset of programs which are offered by the College of Education. Colleges of education vary in modes of operation which can be described in terms of ownership, funding, employment, payment of salaries, promotions, leave allowance, procurement of facilities among others (Adeyinka, 2010). In terms of ownership, these institutions are categorically grouped into Public and Private Institutions. Public tertiary institutions are owned by either federal or state governments while private institutions are owned by either individuals or private organizations. In the course of this study the researcher is concerned with public and private colleges of education in Enugu state; this is because COE are saddled with responsibility of preparing the basic levels of teachers in Nigerian system of Education. In Enugu state, there are eight (8) accredited Colleges of Education out of which four (4) are public and four (4) are private colleges of education. The major differences in the public and private colleges of education are as follows: In terms of Ownership and funding: Public schools are those schools that are established and owned by either federal or state government (Adeyinka, 2010). These schools are managed, financed as well as supervised by the government. They do not do this for profit making. In terms of funding and financial aid public COE have more opportunities than the private. On the other hand, private COE are owned by private individuals, private groups or organizations, to educate the students and to make profit. The owners of private COE are profit earners due to the fact that they invested their money in building, equipping, making provision for necessary facilities, and equipment, and employed competent staff, pay salaries, all for the purpose of giving quality education to students and also to make profit (Adeyinka, 2010).

Despite the crucial role physics plays in National development, the learning outcome of physics education in COE is not satisfactory. There exists evidence of poor academic performance in this subject. This was evident in the survey conducted by researcher on the level of students' achievement in selected courses in physics education. The results showed that PHY 111, PHY 112, PHY 201, PHY 211in 2018/2019, 2019/2020 and 2020/2021 academic session showed that failure rate was at the tone on 35.67%, 40% and 46.82% respectively. According to Adebayo (2012), the poor achievement of physics students at colleges of education is very appalling and attributed this failure to unavailability of ICT resources. Again, Olusola and Rotimi (2012) noted poor achievement of physics education students' and attributed the poor achievement of physics students in colleges of education to non-availability and poor usability of physics resources by Physics lecturers in colleges of education. In the same

vein, Oremu (2010) stressed that the problem of poor performance in this subject will have grave effects on the society as a whole in terms of dearth of manpower in all spheres of the economy if left unsolved.

Information and Communications Technology (ICT) is an instrument that has initiated transition of emphasis from analogous education to digital research based in education (Jude & Dandkoro, 2012). ICT is an innovation with a wide range of digital pedagogical resources available nowadays for teachers and students. Broadly speaking, ICT includes all forms of educational technology in learning and teaching. E-learning comprises technology enhanced learning (TEL), internet based training (IBT), web-based training (WBT), computer based interaction (CBI), computer based training (CBT), computer-assisted instruction or computer aided instruction (CAI), online education, virtual education, virtual learning environment (VLE) which is also known as learning platforms and digital educational collaboration (DEC). The researcher stated that the use of ICT has greater benefit to students, teachers and other stakeholders as it provides access to information with the latest technologies, engage students in learning process and skills which will be useful in social life and in the world of work, promote motivation of students and teachers to engage in teaching and learning for indebt knowledge of Physics education, enhance students critical thinking, eliminate geographical barriers, support lifelong learning, reduce costs and increase efficiency at educational institutions. ICT enhances education through curriculum development design and innovation, which will put in place appropriate human and material instructional resources for effective teaching and learning of physics education in colleges of education. Application of ICT tools in teaching and learning of physics education is enhanced by the following tools internet, emails, e-library, platforms, video conference, disks, flash memories, multimedia projectors, interactive white boards (clever boards) and many more. Others are ICT software such as Word processing, Blogs, desktop publishing program, database program, spreadsheet, etc. These new ICT resources play crucial roles in virtually all areas of modern information delivery. According to Nikky (2010) ICT teaching resources are different equipment available in the classroom. The processes of teaching-learning depend upon the different types of equipment available in the teaching environment or classroom. Teaching resources are therefore all the facilities, equipment and materials utilized by the teacher in teaching the students. Ugwuanyi (2013) observed that teaching resources facilitate proper understanding by the students and discourage the act of cramming. It also makes the classroom or learning environment lively and active. In this study teaching resources refer to varieties of ICT resources used for teaching and learning physics education. According to Nguyen, Williams & Nguyen (2012), the application of ICT resources has helped to improve students' understanding and leading to greater achievement and retention of the subject matter. According to Ugwuanyi (2013), teaching resources are information carriers designed specifically to fulfill objectives in a teaching learning situation**.** In the teaching learning process, lecturers aim at maximizing learning and to achieve this, they employ varieties of

teaching resources to arouse all the senses in the learning process. It is believed that the more the sense organ are involved during teaching/ learning processes, the greater the effectiveness of such teaching as the sense organs are get-way to knowledge. The application of ICT materials and equipment in the classroom helps to improve the teaching and learning and permit teachers and learners to interact effectively in a teaching and learning situation. (National Policy on Education (NPE), 2014).

Availability is presence of material criterion for repairable systems that accounts for both the reliability and maintainability properties of a component or system. Availability is defined as the probability that the system is operating properly when it is requested for use (Amesi & Yellowe, 2018). That is, availability is the probability that a resource is functioning normally and not undergoing repair when it needs to be used. Thus the researcher intends to investigate in this study the much available ICT resources in colleges of education in Enugu State.

Utilization is defined as the actual use of materials available for teaching and learning purposes. Utilization is the primary technique wherein success and performance efficiency are determined. This is especially in the case with tools and equipment. Resource utilization is an integral part of the overall management of the school (Titialoyes, 2017). This included the use of ICT and other instructional materials. In this study this refers to the use of ICT resources specifically interactive white boards (clever boards) and multimedia projectors. These two components of ICT are chosen due to its spectacular measures in ensuring effective teaching of Physics through Audio visual enhancement.

The different types and components of multimedia projectors are Cathode Ray Tube (CRT) projectors, Liquid Crystal Display (LCD) projectors, Digital Light Processing (DLP) projectors, Pico projectors, Light Emitting Diode (LED) projectors and 3-D projectors. In the same way clever boards have different types and components such as Resistive Technology boards, Electromagnetic white boards, Laser scanner, Ultrasound/ Infrared, IWB software, desktop/laptop. For physics lecturers to be able to apply ICT resources in the physics classrooms, they need to have indebt knowledge and the practical skills on ICT. Despite the development in the capacities of ICT and its impact on teaching and learning, Uchendu (2012), stated that the level of application of ICT resources in Nigerian Colleges of Education is less than five percent. The researcher therefore includes usability status of ICT resources among the variable to be investigated. In other to improve learning of Physics in Colleges of Education, the present study centred on the use of interactive white boards (clever boards) and multimedia projectors as ICT resources. This is because these resources encourage student engagement, makes the learning process more enjoyable, accommodates different learning styles, makes lesson revision more convenient and reduces classroom costs. Interactive white boards (clever boards) and multimedia projectors are among the new technological advancements that are widely used in the classroom nowadays to increase students' knowledge and motivation (Uchendu, 2012). They are ICT resources that have

interactive projection display that projects the computers video output. It operates with the combination of the interactive whiteboard, a computer, a projector, and Smart Board software. The projection screen is available as a white board or as a display frame that fits over a plasma screen. The board can either be mounted or portable. The device is touch screen that allows the operator to manipulate content with the touch of a finger. Interactive white boards (clever boards) and multimedia projectors were preferred over the others because they are very easy to use. The boards do not use chalk or markers (which can be messy); it only uses finger or a special pen (Uchendu, 2012). It provides students with an enriched learning experience by projecting visual elements. It also makes learning much easier because lecturers are able to accommodate different learning styles. In addition to that, a student's learning experience is also enhanced by this technology because of its ability for students to view diagrams, charts, videos, and more right on the huge screen in front of them. Their learning comes to life, and many students find it more fun to learn than ever before.

National Policy on Education (NPE, 2014) opined the use of interactive white boards (clever boards) in the classroom can make a difference for students who have trouble with thinking abstractly in abstract subjects, because it makes the teaching/ learning process more concrete, when using the features of the interactive white boards (IWBs) (Uchendu, 2012). The potential benefits of clever boards for teaching also are: flexibility and versatility, multimedia/ multimodal presentation, efficiency, supporting planning and the development of resources, modeling information and communication technologies skills, interactivity and lesson participation. Also, they find the unique features of IWBs relate to the promotion of students' learning skills (Ruhul, Mahedi and Abul, 2018). The use of Multimedia projector in the class enables lecturers to deliver a topic not only verbally but also visually which offers much supportive for students and gives room for more concentration in the class. Students are also able to discuss together between the verbal and non-verbal as well as theoretical and material issues (Ruhul, *et al*., 2018). Therefore, this study seeks to examine the availability and utilization of ICT resources in teaching and learning physics education in colleges of education in Enugu State, Nigeria irrespective of gender.

Gender has been noted by researchers over the years as having impact on achievement in Physics and its related disciplines (Akumah, 2013). Akumah even stressed that science, technology and their related disciplines are male-reserved while Art and Humanities are female reserved. This belief makes boys appear to have a natural positive attitude towards science and technical subjects while girls show more inclination to Arts and Humanities. The problem is even compounded by the fact that most science educators give masculine outlook to science subjects such as chemistry and physics (Akuma, 2013); encouraging females to go rather for biology, agricultural science and home economics which they consider to be more female-friendly science subjects. Unegbu, Ogugua, Nnadimele and Nse (2019) noted that male lecturers in the institutions of higher learning embrace the use of ICT resources more than their female counterparts.

Also, Agnetha (2005) opined that generally females had negative attitudes towards the use of ICT resources. Several studies have examined the use of ICT resources with respect to gender differences in proficiency. According to Mumporeze and Prieler (2017), females lecturers have limited access to ICT resources than their male counterparts and that males generally are more ICT competent than their female counterparts. Again, studies of Lee, Czaja, Moxley, Sharit, Boot, Charness and Rogers (2019); and Tam, Chan and Lai (2020), observed that female showed more proficiency in the use of ICT in teaching and learning. Based on the differences in the opinion of researchers, there is need for inclusion of gender as a variable in this study to further shed light on the controversial gender difference in ICT proficiency. Furthermore, availability of ICT resources is observed to depend on the large extent of school type and ownership of secondary schools in Enugu State.

School type can be described as those variables that constitute the ownership of a school in a given community. The ownership of schools is predominantly of two categories: Public and Private Ownership. Public secondary school are the types of schools owned and managed by the government; while private schools are the schools that are owned and managed by private individuals or partners with common interest and goal. According to Abubakar (2014), the availability or absence of ICT for teaching and learning of biology is purely dependent on the ownership of the school. School type has direct influence on classroom use of ICT-based instructional strategies such as resources availability (human and material); school ICT culture and community participation which is clearly determined by school type (Ugwuanyi, 2013). Human resources such as computer technicians, computer experts among others, and material resources such as computer hardware and software, well-equipped computer laboratory, projectors and portable screen are prior demonstration of school culture on interest and essential to provide motivation and encouragement that can influence teachers to adopt ICT-based instructional strategies into classroom teaching of biology. Ugwuanyi (2013) maintained that training programme for staff on ICT proficiency is a demonstration of desire accorded to school type. Tinio (2012) highlighted the importance of infrastructural facilities that is linked with school culture. School culture can be defined as the set of shared values, beliefs and norms that influence the way educators and administrators think, feel, and behave in school place (Agyei, 2013). School ICT culture refers to the school tradition in using computer- based technology for administrative and academic activities in the school. For example; use of e-mail and text messages to communicate with the staff and students, accessing students and important school programmes online through school portal. Such a tradition will provide stimulating environment for use of ICT-based instructional strategies. From the available literature, and to the best knowledge of the researchers, not much works have been done on availability and usability status of ICT resources for physics education in COE in Enugu state. Therefore, this work is poised determine the availability and utilization of ICT resources in teaching and learning of physics in Colleges of Education in Enugu State.

Statement of the Problem

The Scientific and technological development of any nation depends on the level of scientific skills possessed and utilized by her citizens. This is why Science education of the 21st century should adopt life competencies as part of innovation in a digital age science education. For the scientific and technological development of any nation to be attained, Physics knowledge is very much required. Despite the crucial role physics plays in the education and training of future physics teachers, there is a decline in achievement in physics in Colleges of education. Some researchers attributed the poor achievement of physics students in colleges of education to non-availability and poor usability of ICT resources by Physics lecturers in colleges of education. Some attributed it to low level of ICT proficiency by physics lecturers in the colleges of education. Other researchers argued that school type and gender of the lecturers are the major factors hindering available and usability of the ICT resources for teaching physics in colleges of education. This lingered problem has resulted in low enrollment of physics students in colleges of education; and consequently resulted to poor proficiency of physics education graduates in colleges of education. In view of the on-going, the present study identifies availability and utilization of ICT resources for teaching physics whose impart in teaching and learning physics in colleges of education in Enugu State have not been so much reported in the literature. Therefore, the problem of this study is put in a question form "What is the availability and utilization of ICT resources for teaching physics in colleges of education in Enugu State?

Purpose of the Study

The purpose of the study was to determine the availability and utilization status of Clever board and multimedia projectors for teaching and learning of physics Education in public and private Colleges of Education in Enugu State. Specifically, the study sought to determine the:

1. Availability status of clever board for teaching and learning Physics in public and private Colleges of Education in Enugu State.
2. Availability status of multimedia projectors for teaching and learning Physics in public and private Colleges of Education in Enugu State.
3. Utilization status of clever board for teaching and learning Physics in public and private Colleges of Education in Enugu State.
4. Utilization status of multimedia projectors for teaching and learning Physics in public and private Colleges of Education in Enugu State.

Research Questions

The following research questions guided the study.

1. What is the mean of the availability status of clever boards for teaching and learning Physics in public and private Colleges of Education in Enugu State?

2. What is the mean of the availability of multimedia projectors for teaching and learning Physics in public and private Colleges of Education in Enugu State?
3. What is the utilization of clever board in teaching and learning Physics in public and private Colleges of Education in Enugu State?
4. What is the utilization of multimedia projectors in teaching and learning Physics in public and private Colleges of Education in Enugu State?

Method

The study employed a census survey research design. A census survey research design is one which data is collected from every member of the population studied (Nworgu, 2018). The census survey research design was considered most appropriate for this study because it provides a complete view of all the members of the population under study. The study was carried out in Enugu state. Enugu State is one of the states in the Eastern part of Nigeria located at the foot of the Udi Plateau in the South Eastern geopolitical zone. Enugu State is made up of 17 local government areas. Enugu State shares borders with Abia and Imo states in the South, Ebonyi state in the East, Kogi in the Northwest and Anambra state in the Western part of Nigeria. Enugu state has six education zones namely Agbani, Awgu, Enugu, Nsukka, Obollo Afor and Udi education zones. Enugu State has eight colleges of education, encompassing both public and private colleges of education, universities, polytechnics and many secondary schools. The considerable large number of the colleges of education and other institutions of learning in the state depict that the people in the area like education and are mostly civil servants.

The researcher chose Enugu state due to the fact that most of the colleges of education have qualified physics lecturers, laboratories, ICT tools and other instructional materials and yet students experience difficulties in answering questions in physics in their examinations. The population for the study was made up of 30 physics lecturers who are currently serving in eight Colleges of Education (COE) in Enugu State. Among whom are 21 male lecturers and nine (9) female lecturers. Also 20 physics lecturers are teaching in public COE and 10 are in Private COE. The entire population constituted the sample size used for the study due to the fact that the population is small and manageable. Hence, there was no sampling. The instrument for data collection for this study was a structured questionnaire adapted from NCCE checklist, the response option was increased from 2 to 4. The researcher named the instrument "Availability and Utilization Status of ICT Resources for Physics Education Questionnaire" (AUSICTRPEQ) besides the researcher's direct observations. Direct observations with the checklist were used by the researcher in determining the availability status of ICT resources for effective teaching and learning of physics in COE in Enugu State. The researcher adapted items 1- 46 because of its relevance to clever board and multimedia projectors as major components of the study. The (AUSICTRPEQ) consisted of Ninety-two (92) item based on research questions 1-4. The (AUSICTRPEQ) was

arranged in two sections of Section A and Section B. Section A concerned with the personal/ demographic data of the respondents. The information that was supplied by the respondents in this section A was used in answering research questions 5-10 and testing the hypotheses. Section B was concerned with the data required for answering the research questions 1-4. Section B consisted of a total number of 54 items arranged in four (4) clusters based on research questions 1-4.

Clusters 1 and 2 have 25 and 21 items per cluster respectively with two response options of A (Available) or NA (Not- Available). These clusters were concerned with Available ICT resources for use by Physics lecturers in teaching and learning physics in COE while clusters 3 and 4 will be a rating scale and was concerned with the extent of utilization of the available ICT resources by physics lecturers in teaching and learning physics. Specifically ,clusters 3 and 4 consists of 25 and 21 items per cluster respectively with four points rating scale response options of VHE- Very high extent, HE- High extent, LE- Low extent, VLE- Very low extent. The instruments were validated by three experts from ESUT. The instruments were tested for internal consistency reliability using Kuder-Richardson- 20 and Cronbach's alpha which yielded a coefficient of 0.98 and 0.96 indices respectively for availability and utilization items. The instrument was distributed to the respondents upon selection through the help of the research assistants who doubled to be their physics teachers in their respective schools. Research questions 1 and 2 were answered using mean, and Standard deviation. This was appropriate because it has only two options of Available or Not available. The mean responses that was greater than zero was rated as positive (available) while mean scores less than or equal to zero was rated as negative (Not available). Research questions 3-10 was answered using mean and standard deviation responses with values of 4,3,2 and 1 for very high extent (VHE), high extent (HE), Low Extent (LE), Very Low Extent (VLE) respectively was assigned to responses from which a mid-point mean value was calculated. Hypotheses were tested using t-test statistics. The choice of t-test is because more than one group was involved (school type and gender).

Results

Research Question 1:

What is the mean of the availability status of clever boards for teaching and learning Physics in public and private Colleges of Education in Enugu State?

Table 1: Mean and Standard deviation of Availability status of Clever board for teaching and learning of Physics in Colleges of Education in Enugu State

S/N	Items	Mean ( )	SD	Status
1	Resistive Technology boards	0.30	0.47	FA
2	Electromagnetic white boards	0.73	0.45	HA
3	Electronic graphics board	0.00	0.00	NA
4	Magnetic cards for recording	0.70	0.47	HA

5	Mobile communication gadgets such as iPad, itouch	0.87	0.35	HA
6	Electronic readers	0.00	0.00	NA
7	Fax machine	0.03	0.18	FA
8	Mobile resources such as MP3, MP4, MP5 etc	0.87	0.35	HA
9	Laser scanner	0.03	0.18	FA
10	Ultrasound /Infrared	0.13	0.35	FA
11	IWB Software	0.33	0.48	FA
12	Desktop Computers	0.97	0.18	HA
13	UPS	0.47	0.51	A
14	e- library containing Physics text books	0.93	0.25	HA
15	CD-ROMs	0.63	0.49	A
16	Stylus Pen	0.67	0.48	A
17	Android Cell Phone	1.00	0.00	HA
18	Television set	0.53	0.51	A
19	Alternative Power Supply	1.00	0.00	HA
20	Podcasts and streaming such as podcast, iLecture etc.	0.07	0.25	FA
21	Shared documents e.g. SlideShare, Google Docs etc.	0.67	0.48	A
22	Computer software such as MS excel, MS word etc.	1.00	0.00	HA
23	Optical	0.03	0.18	FA
24	Flash memories	0.40	0.50	A
25	Audio and video disc	0.43	0.50	A
	Grand Mean/ SD	**0.50**	**0.29**	**A**

Key: SD = Standard Deviation, HA = Highly Available, A = Available, FA = Fairly Available, NA = Not Available

The data presented in Table 1 reveals that items 3 and 6 have means of 0.00, indicating that the items are not available for teaching and learning of Physics in Colleges of Education in Enugu State. In the same vein, the means of items 1, 7, 9, 10, 11, 20 and 23 have means ranging from 0.01 – 0.39, indicating that the clever board of ICT tools are fairly available for teaching and learning of Physics in Colleges of Education in Enugu State. Again, the means of items 13, 15, 16, 18, 21, 24 and 25 have means ranging from 0.40 – 0.69, indicating that the clever board of ICT are available for teaching and learning of Physics in Colleges of Education in Enugu State. Furthermore, the means of items 2, 4, 5, 8, 12, 14, 17, 19 and 22 have means ranging from 0.70 -1.00, indicating that the clever board of ICT are highly available for teaching and learning of Physics in Colleges of Education in Enugu State. Generally, the grand mean of the items is 0.50, indicating that clever board is available for teaching and learning of Physics in Colleges of Education in Enugu State. Table 1 also shows that the Standard deviations (SD) of all the items are within the range of 0.00 to 0.51 and are positive which indicates that the respondents were not very far from one another in their responses.

Research Question 2:
What is the mean of availability of multimedia projectors for teaching Physics in teaching and learning Physics in Colleges of Education in Enugu State?

Table 2: Mean and Standard deviation of Availability status of Multimedia projector for teaching and learning of Physics in Colleges of Education in Enugu State

S/N	Items	Mean ( )	SD	Status
26	Cathode Ray and learning Tube (CRT) projectors	0.03	0.18	FA
27	Liquid Crystal Display (LCD) projectors	0.00	0.00	NA
28	Digital Light Processing (DLP) projectors	0.97	0.18	HA
29	Pico projector	0.00	0.00	NA
30	Light Emitting Diode (LED) projectors	0.13	0.35	FA
31	3 –D projectors	0.00	0.00	NA
32	Overhead projector	0.97	0.18	HA
33	USB Flash	0.53	0.51	A
34	Portable Video games	0.47	0.51	A
35	DVD	0.97	0.18	HA
36	Internet Connection Modem	1.00	0.00	HA
37	Laptops	1.00	0.00	HA
38	Audio System	0.47	0.51	A
39	Digital cameras	1.00	0.00	HA
40	Transparencies	0.13	0.35	FA
41	Wiki such as wikispaces, wikipad, Wikipedia	0.27	0.45	FA
42	Digital Repositories e.g. Google scholar, YouTube,	0.70	0.47	HA
43	Assessment and survey tools e.g. Exam & Quiz Builder	1.00	0.00	HA
44	Asynchronous communications e.g. email, forums	0.97	0.18	HA
45	Synchronous communications e.g. Google talk, iChat	0.43	0.50	A
46	Satellite	0.70	0.47	HA
	GRAND MEAN/ SD	**0.56**	**0.24**	**A**

The data presented in Table 2 reveals that items 27, 29 and 31 have means of 0.00, indicating that the items of multimedia projectors are not available for teaching and learning of Physics in Colleges of Education in Enugu State. In the same vein, the means of items 26, 30, 40 and 41 have means ranging from 0.01 – 0.39, indicating that the multimedia projectors of ICT tools are fairly available for teaching and learning of Physics in Colleges of Education in Enugu State. Again, the means of items 33, 34, 38 and 45 have means ranging from 0.40 – 0.69, indicating that the multimedia projectors of ICT are available for teaching and learning of Physics in Colleges of Education in Enugu

State. Furthermore, the means of items 28, 32, 35, 36, 37, 39, 42, 43, 44 and 46 have means ranging from 0.70 -1.00, indicating that the multimedia projectors of ICT are highly available for teaching and learning of Physics in Colleges of Education in Enugu State. Generally, the grand mean of the items is 0.56, indicating that multimedia projector is available for teaching and learning of Physics in Colleges of Education in Enugu State. Table 2 also shows that the Standard deviations (SD) of all the items are within the range of 0.00 to 0.51 and are positive which indicates that the respondents were not very far from one another in their responses.

Research Question 3:
What is the utilization of clever board in teaching and learning of Physics in public and private Colleges of Education in Enugu State?

Table 3: Mean and Standard deviation of Utilization status of clever board for teaching and learning of Physics in Colleges of Education in Enugu State

S/N	Items	Mean ( )	SD	Status
47	Resistive Technology boards	1.55	0.78	FU
48	Electromagnetic white boards	2.17	0.80	U
49	Electronic graphics board	1.21	0.49	FU
50	Magnetic cards for recording	2.48	0.99	U
51	Mobile communication gadgets such as iPad, itouch	2.03	0.33	U
52	Electronic readers	1.17	0.38	FU
53	Fax machine	1.21	0.41	FU
54	Mobile resources such as MP3, MP4, MP5 etc	2.55	0.63	U
55	Laser scanner	1.59	0.91	FU
56	Ultrasound /Infrared	1.52	0.83	FU
57	IWB Software	1.93	0.88	FU
58	Desktop Computers	2.76	0.83	U
59	UPS	1.69	0.76	FU
60	e- library containing Physics text books	2.10	0.62	U
61	CD-ROMs	2.14	0.74	U
62	Stylus Pen	2.72	1.10	U
63	Android Cell Phone	3.41	0.68	HU
64	Television set	2.41	0.63	U
65	Alternative Power Supply	2.41	0.91	U
66	Podcasts and streaming such as podcast, iLecture etc.	1.34	0.61	FU
67	Shared documents e.g. SlideShare, Google Docs etc.	2.28	0.92	U
68	Computer software such as MS excel, MS word etc.	2.41	0.68	U
69	Optical	1.21	0.56	FU
70	Flash memories	1.72	0.88	FU
71	Audio and video disc	1.62	0.82	FU
	Grand Mean/ SD	**1.99**	**0.73**	**FU**

Key: SD = Standard Deviation, HU = Highly Utilized, U = Utilized, FU = Fairly Utilized, NU = Not Utilized.

The data presented in Table 3shows that items 47,49, 52, 53, 55, 56, 57, 59, 66, 69, 70 and 71 have means ranging from 1.0 – 1.9, indicating that the clever board of ICT resource are fairly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. In the same vein, the means of items 48, 50, 51, 54, 58, 60, 61, 62, 64, 65, 67 and 68 have means ranging from 2.0 – 2.9, indicating that clever board of ICT resources are utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Again, the item 63 has mean range of 3.0 – 4.0, indicating that clever board is highly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Generally, the grand mean of the items is 1.99, indicating that clever board is fairly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Table 2 also shows that the Standard deviations (SD) of all the items are within the range of 0.33 to 1.10 and are positive which indicates that the respondents were not very far from one another in their responses.

Research Question 4:
What is the extent of utilization of multimedia projectors in teaching and learning Physics in Colleges of Education in Enugu State?

Table 4: Mean and Standard deviation of Utilization status of multimedia projector for teaching and learning of Physics in Colleges of Education in Enugu State.

S/N	Items	Mean ( )	SD	Status
72	Cathode Ray Tube (CRT) projectors	1.48	.57	FU
73	Liquid Crystal Display (LCD) projectors	1.45	.51	FU
74	Digital Light Processing (DLP) projectors	2.03	.82	U
75	Pico projector	1.14	.44	FU
76	Light Emitting Diode (LED) projectors	1.31	.47	FU
77	3 –D projectors	1.66	.77	FU
78	Overhead projector	1.90	.77	FU
79	USB Flash	2.21	1.08	U
80	Portable Video games	1.72	.59	FU
81	DVD	2.21	.62	U
82	Internet Connection Modem	2.69	.66	U
83	Laptops	2.66	.67	U
84	Audio System	2.24	.95	U
85	Digital cameras	2.31	.85	U
86	Transparencies	1.55	.78	FU
87	Wiki such as wikispaces, wikipad, Wikipedia	1.48	.78	FU

88	Digital Repositories e.g. Google scholar, YouTube,	2.31	1.04	U
89	Assessment and survey tools e.g. Exam & Quiz Builder	3.14	.52	HU
90	Asynchronous communications e.g. email, forums	2.45	.63	U
91	Synchronous communications e.g. Google talk, iChat	1.72	.84	FU
92	Satellite	2.00	.80	U
	Grand Mean/ SD	**1.98**	**0.72**	**FU**

The data presented in Table 4 shows that items 72, 73, 75, 76, 77, 78, 80, 86, 87 and 91 have means ranging from 1.0 – 1.9, indicating that the multimedia projectors of ICT resource are fairly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. In the same vein, the means of items 74, 79, 81, 82, 83, 84, 85, 88, 90 and 92 have means ranging from 2.0 – 2.9, indicating that multimedia projectors of ICT resources are utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Again, the item 89 has mean range of 3.0 – 4.0, indicating that multimedia projector of ICT is highly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Generally, the grand mean of the items is 1.98, indicating that multimedia projectors are fairly utilized for teaching and learning of Physics in Colleges of Education in Enugu State. Table 4 also shows that the Standard deviations (SD) of all the items are within the range of 0.44 to 1.08 and are positive which indicates that the respondents were not very far from one another in their responses.

Discussion of the Findings

The findings of the study revealed that the grand mean of the items is 0.50, indicating that the Clever Board is available for teaching and learning physics in Colleges of Education in Enugu State. The findings of the study also showed that the standard deviation (SD) of the items are within the range of 0.00 – 0.50 and are positive, which indicates that the respondents were homogenous in their responses. This finding is in tandem with Kiptalam and Rodriguess (2011) who stated that the integration of the new technology into education is exceedingly reliant on the accessibility and availability of the resources in schools. The findings of this study disagrees with Leach (2008), Nwana (2007; 2008b and 2012) that the new information and communication technologies (ICTs) needed for achieving the goals of education for all are not available. They noted that the new technologies needed for effective ICT implementation in schools are not available. Again, the findings does not aligns with Jegede and Owolabi (2008) that there is dearth of infrastructural facilities for the teaching of computer Education and general science. The finding disagrees with the Global ICT Report (2012) that Nigeria ranked 112 out of 142 countries surveyed for network readiness to participate and benefit from ICT development.

The findings showed that the grand mean of the items is 0.56, indicating that multimedia projector is available for teaching and learning physics in colleges of education in Enugu State.

The findings of the study also revealed that the standard deviation (SD) of all the items are within the range of 0.00 -- 0.51 and are positive which indicate that the respondents were not very far from one another in their responses. This finding is in agreement with Samaila et al (2021) who posited that the availability and integration of interactive multimedia tools in effective teaching and learning helps students to improve their understanding in various abstract subjects such as physics. The findings of this study disagrees with Leach (2008), Nwana (2007; 2008b and 2012) that the new information and communication technologies (ICTs) needed for achieving the goals of education for all are not available. They noted that the new technologies needed for effective ICT implementation in schools are not available. Again, the findings does not aligns with Jegede and Owolabi (2008) that there is dearth of infrastructural facilities for the teaching of computer Education and general science. The finding disagrees with the Global ICT Report (2012) that Nigeria ranked 112 out of 142 countries surveyed for network readiness to participate and benefit from ICT development.

The findings of the study revealed that the grand mean of the items is 1.99, indicating that the Clever Board was fairly utilized for teaching and learning of physics in colleges of education in Enugu State. Further, analysis showed that the standard deviations of all the items are within the range of 0.033 to 1.10 and are positive which indicates that the respondents were homogenous in their responses. This is in agreement with Gilaktejani (2012) who stated that when student's interest increases, understanding, becomes enhanced and retention ability increased, there is the tendency for an improvement in academic achievement of the students. This finding disagrees with the findings of Ololube (2006) and Pelgrum (2012) that observed that there is poor ICT resources integration and usage in the school system for taching and learning purposes. Again, the finding is not in conformity with Pumer (2011) and Nwana (2008b) that the teachers lack the necessary skills and competencies in the use of ICT resources for teaching and learning of science subjects. The finding is also in discord with Amedu (2014) that secondary school teachers lack the skills to fully utilize e-learning technology in curriculum implementation hence, the traditional chalk and duster approach still dominate in secondary school pedagogy, meanwhile the study provided that lecturers in colleges of Education have possessed necessary skills and implement ICT integration.

The findings revealed that the grand mean of all the items is 1.98, indicating that multimedia projector are fairly utilized for teaching and learning of physics in colleges of education in Enugu State. Further analysis of the study revealed that the standard deviations of all the items are within the range of 0.44 – 1.08 and are positive which indicated that the respondents were not very far from each other in their responses. This finding correlates with the discovery of Fakeye (2010) that most Colleges of Education in Nigeria are not well prepared for the utilization of ICT resources. This finding

disagrees with the findings of Ololube (2006) and Pelgrum (2012) that observed that there is poor ICT resources integration and usage in the school system for teaching and learning purposes. Again, the finding is not in conformity with Pumer (2011) and Nwana (2008b) that the teachers lack the necessary skills and competencies in the use of ICT resources for teaching and learning of science subjects. The finding is also in discord with Amedu (2014) that secondary school teachers lack the skills to fully utilize e-learning technology in curriculum implementation hence, the traditional chalk and duster approach still dominate in secondary school pedagogy, meanwhile the study provided that lecturers in colleges of Education have possessed necessary skills and implement ICT integration.

Conclusions/Recommendations

The study is centered on the availability and utilization status of ICT Resources for Physics Education in Colleges of Education in Enugu State. In view of the findings of this study, the following conclusions were drawn In view of the learning effectiveness and benefits of clever boards in the classroom; it is recommended that all teachers particularly the physics teachers are encouraged to be using the clever boards in the classroom. Physics textbooks authors should develop books that will reflect the use of ICT tools with teacher's guides. Government and relevant professional associations should sponsor further research on the effectiveness of use of ICT Resources (clever board and multimedia projectors) in enhancing students' academic achievements in physics and other science subject. As new innovation, teachers should be properly taught how to use the new technology.

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